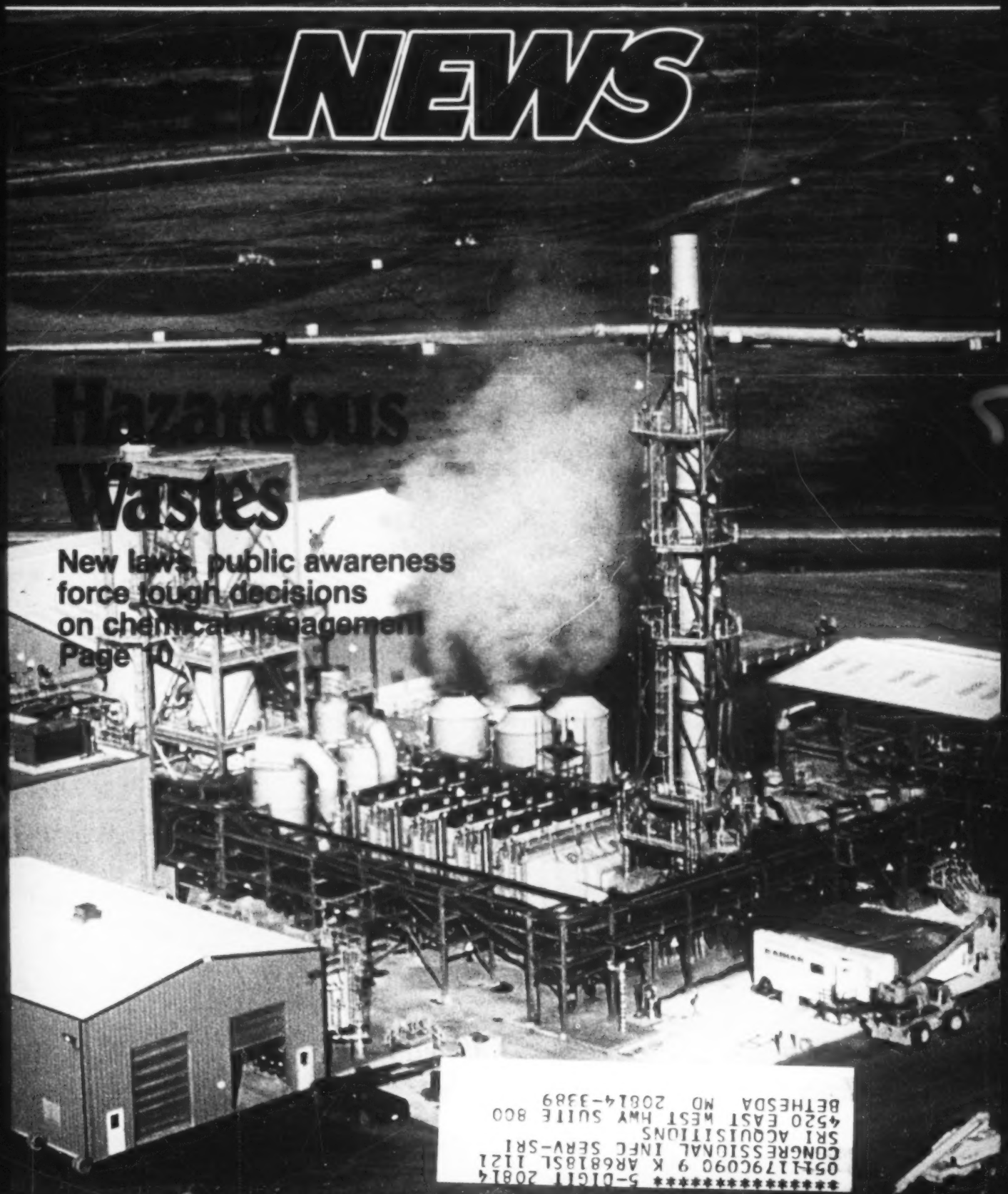
APRIL 30, 1990

CHEMICAL & ENGINEERING

# NEWS



## Hazardous Wastes

**New laws, public awareness force tough decisions on chemical management**

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CHEMICAL & ENGINEERING NEWS

APRIL 30, 1990

## News of the Week

■ **Earth Day activities included many by chemical industry although its involvement was decried as a "greenwash" campaign by some environmental groups.** Page 4

■ **NAS elects 60 new members, and 15 foreign associates, several of whom are chemists.** Page 6

■ **Labor Department report calls for better petrochemical industry safety plans that would reduce potential for catastrophes like the Phillips 66 disaster last fall.** Page 6

■ **Dallas investor Harold Simmons to sell stake he controls via NL Industries in Georgia Gulf.** Page 7

■ **President Bush addresses NAS's annual meeting, the third president in this century to do so.** Page 7

■ **New series of synthetic sweeteners were developed through rationally planned research and computer design methods.** Page 8

■ **Du Pont's new amorphous fluoropolymers exhibit enhanced physical properties.** Page 8

■ **ACS Boston meeting, which attracted more than 13,000 attendees, highlighted theme of educating future scientists.** Page 9

*Cover:* Chemical Waste Management's new rotary kiln incinerator at Port Arthur, Tex., is the largest commercial unit of its kind in the U.S. Photo courtesy of Chemical Waste Management

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## Business

**Agricultural biotech firm, Mycogen,** will soon bring to market a new generation of biopesticides that it claims are as effective as chemical pesticides but safer to the environment. **Page 18**

**Outlook for propylene prices depends on demand for polypropylene,** which accounts for nearly 40% of U.S. use of the monomer in chemicals and polymers. **Page 21**

## Government

**Congress is busy setting 1991 budgets** for various federal agencies, after returning from its Easter recess. **Page 24**

## Education

**Conference on freshman year in science and engineering** affirms that research-oriented science faculties have a duty to contribute part of their time to improving the teaching of science. **Page 27**

## ACS News

**Committee on Professional Training reports** on 1989 bachelor's, master's, and Ph.D. graduates of ACS-approved schools; University of California, Berkeley, and Indiana University are top producers of Ph.D. chemists. **Page 29**

## News Focus

**Managers of chemical firms face rising pressure from local environmental groups, growing antiwaste legislation, and the need to find new disposal methods in their efforts to meet hazardous waste rules.** **Page 10**

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# LETTERS

## CHEMICAL SAFETY

### Solvent extraction hazard

SIR: This letter calls attention to a hazard associated with the environmental analysis of water samples requiring solvent extraction using separatory funnel technique.

In the analytical determination of chlorinated phenoxy herbicides in water, the following extraction procedure was being used. A 1-L well water sample (laboratory reagent blank) was acidified to pH 2 with phosphoric acid. Then 60 mL methylene chloride solvent was added. The glass stopper was placed on the 2-L separatory funnel and inverted. Immediately upon inverting, before venting could take place or any shaking had begun, the flask literally exploded, sending glass through the chemist's clothing into his chest, cutting an artery and several veins. Both internal and external stitches and cauterization were required. The chemist has recovered; however, the accident could have been much more severe.

This type of extraction has been done for nearly 20 years at our laboratory without incident. In summary, a word of caution to all chemists that even the most routine analysis whenever glass and pressure are involved can become very hazardous when the unexplainable occurs.

**Ray E. Kelling**
*North Carolina Department of Environment, Health & Natural Resources, Raleigh*

### Methanol as fuel

SIR: The diatribe of Charles R. Sloan (C&EN, Dec. 4, 1989, page 57) against the use of alcohols, particularly methanol, as auto or diesel fuel is fascinating. He integrates into this small part of technology's almanac—not 365 days of next year's unknown weather—but almost as many predictions at the fringe of truth or possibility. His one firm, unassailable conclusion is: no good.

The author of the book ["New Transportation Fuels: a Strategic Approach to Technological Change"] is correct, indeed—despite Sloan's carping criticism—in that fuels do possess an attribute that does give power to engines that are designed to use it. Methanol has this chemical attribute. It produces somewhat less energy than does gasoline, but it has a greater efficiency of producing power to a greater extent than gasoline. Methanol's attribute produces in most, if not all, automobile-type engines more power than does gasoline because of methanol's much greater efficiency in combustion.

This greater power that methanol develops in an automobile-type engine of almost any size and weight led to a recent personal survey showing that top racing cars for a generation all have burned methanol instead of gasoline. Possibly equally important among the great attributes (usually called properties) of methanol that have persuaded auto racers of the greater power methanol provides are its far greater safety when used as a fuel (i.e., the lives of drivers it has saved in crash-burns), and the much longer working life it gives to the very expensive, overworked racing engines.

Sloan's basic misconception of fuels, the industry of their manufacture, and their use in transportation is his obliviousness to the indisputable economic fact that manufacturing processes of fuels and other processed materials lose gross weight, cost money to operate, and lose much of the gross heat of the raw fuel in the production and refining of a fluid fuel in a form that can be burned most efficiently and economically in some special mechanical machine.

No one has developed a passenger car with a carburetor to use crude oil, untreated oil shales or tar sand, or even coal dust. Thus there must be a physical and/or chemical conversion of the fuel as mined to produce a fuel usable in any engine that man has been able to devise so far in a full century of attempts. Much of the potential heat of the raw fuel always will be lost—just as the entropy of the universe always will be increased.

Sloan brings no solution. He only weeps bitter tears because fuel processing adds to the entropy of the universe, and manufacturing processes will never be 100% efficient. If Sloan were correct, one would not peel an orange or remove

### Correction

• April 9, page 26: Pierre C. Hohenberg of AT&T Bell Laboratories developed density-functional theory, not Charles M. Hohenberg, as stated.

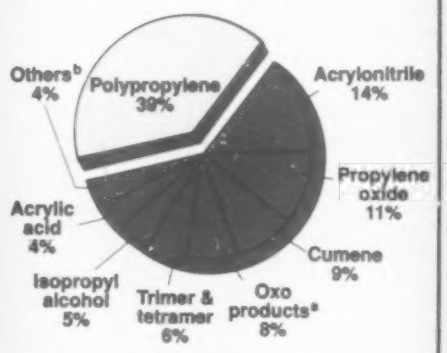
# Propylene price outlook hinges on polymer use

Merchant suppliers of propylene this week will try to add 0.5 cent to May contract prices. If they succeed, prices will be 15.5 to 16 cents per lb for polymer grade. Their success will depend on a price increase for polypropylene, which accounts for almost two fifths of U.S. consumption of propylene in chemicals and polymers.

Following the rapid decline in propylene prices during the last half of 1989 and an inventory liquidation of polypropylene, prices firmed in early 1990 as a result of perceived tightness in supplies. This tightness was caused by temporary shutdowns of plants damaged by unusually cold weather. Prices for propylene, polypropylene, and some other propylene derivatives have been volatile recently because of the difficulties that suppliers have had maintaining announced price increases.

The lost production now has been made up, industry sources say. Consequently, factors other than short-term supply will continue to dominate prices unless another major upset in plant operations occurs. Modest growth in U.S. demand for propylene and derivatives in 1990 will be heavily influenced by inven-

## Polypropylene dominates nonfuel uses of propylene




**Note:** Percentages are derived from reported production of chemicals and polymers. a Includes *n*-butyl alcohol, 2-ethylhexanol, and isobutyl alcohol. b Includes allyl chloride (most of which goes into epichlorohydrin), ethylene-propylene elastomers, and acrolein. c Forecast.
**Source:** C&EN estimates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tory building and exports of polypropylene, sources add.

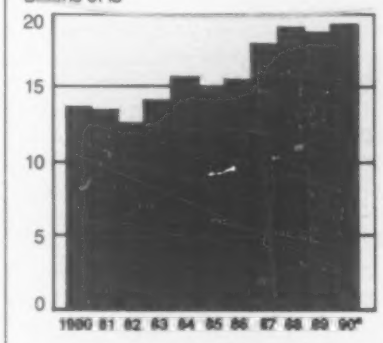
Supply of all grades of propylene could increase this year. Polymer-grade (typically 99.5%) propylene supplies will grow from both additions to steam cracker capacity and expansion of purification (splitter) capacity to raise purity of chemical-grade (typically 95%) propylene or refinery-grade (50 to 70%) propylene. Building of supply will depend on how much chemical and polymer users of propylene are willing to pay to compete for propylene that could be used in gasoline components or burned as fuel in refineries and elsewhere. The volume of propylene produced in refinery catalytic and thermal cracking processes exceeds the volume from steam cracking by severalfold, points out Michael Horvath Jr., manager of Petrocon Associates' Houston office.

Because the cost of feedstocks to refineries and steam crackers basically depends on world crude oil prices, propylene selling prices eventually relate back to crude oil prices. With the recent sizable declines in crude oil prices (reflected partly by declines in wholesale gasoline prices), propylene prices clearly are under pressure, Horvath says. Pressure on propylene prices is forecast to continue well into the third quarter, when demand for fuels normally rises, and will continue until overproduction of petroleum in the world is reduced.

Growing demand for polypropylene potentially could provide an impetus to stronger propylene demand and prices. More than 500 million lb of capacity to make polypropylene is scheduled to start up this year, and more than another 1 billion lb is scheduled for 1991. These polypropylene capacity expansions could add more than 20% to the capacity that was operating at the beginning of this year. However, the developing overcapacity will put pressure on prices of polypropylene and in turn on propylene.

Despite the capacity expansions, polypropylene demand will grow less than 5% this year and next, according to sources. The demand growth could be much less if exports again decline substantially. In 1989 exports fell 12% to about 1.4 billion lb. If the large amount of polypropylene capacity scheduled to start up outside the U.S. produces material as expected, exports from the U.S. could be replaced by local production unless these sales are made up in new markets. As a result, more pressure on prices will occur, causing polymer producers to ask for lower feedstock costs.

**Propylene produced for nonfuel uses to set record**




Note: Not all propylene produced for nonfuel (chemicals and polymers) uses is reported. a Forecast. Sources: International Trade Commission, National Petroleum Refiners Association Petrochemical Committee, C&EN estimates

Largely because of the growth in demand to supply polypropylene expansions, propylene consumption for making chemicals and polymers in the U.S. this year will increase about 5%, to about 21 billion lb. No sizable use of propylene will grow that fast except polypropylene. Therefore, the share of propylene consumption by polypropylene will increase faster than all others except very small uses, says an industry source. Even so, it is unlikely that polypropylene will reach half of propylene consumption by the end of the decade.

Acrylonitrile is a distant second to polypropylene as a consumer of propylene. The outlook for growth in this use depends heavily on the demand for acrylic fibers, which has varied with fashion and economics. Other polymeric uses of acrylonitrile (such as acrylonitrile-butadiene-styrene, styrene-acrylonitrile, and nylon resins) will grow slowly overall and will have little effect on propylene use.

*Bruce Greek*

# ACS Committee on Professional Training 1989 Annual Report

The number of bachelor's degree graduates in chemistry from colleges and universities whose undergraduate chemistry programs are approved by the American Chemical Society decreased 3% in the 1988–89 academic year. This was the smallest decrease in four years. The number of master's degrees from these departments increased 7.5% after a decrease of 3.3% last year. The number of Ph.D. degrees continued to increase for the 11th year in a row. The increase was 0.6%.

The percentage of baccalaureate graduates certified to ACS was a little over 41%, about the same as previous years. (Certified graduates are those who have completed the curriculum specified by the Committee on Professional Training and are eligible for full membership in ACS; noncertified graduates may become associate members of ACS upon graduation and full members after three years of professional experience or a higher degree in a chemical science.)

A total of 2118 of the baccalaureate graduates from the approved schools were reported as planning to go to graduate school, and 1637 reported plans to go to professional schools.

Total numbers of bachelor's degrees (certified and noncertified), master's degrees, and Ph.D. degrees awarded in 1988–89 by departments whose undergraduate chemistry programs are ACS approved are listed by institution in the large table at the end of this report and are summarized in the two smaller tables. These tables also include numbers of chemical engineering graduates from institutions whose programs are accredited by the American Institute of Chemical Engineers and the Accreditation Board for Engineering and Technology. (Note: These departments are not required to report their data to CPT, so the number of departments included varies each year.) Included for the fifth year is a table with information on graduate student enrollments in chemistry departments whose undergraduate programs are ACS approved.

The number of bachelor's degrees in chemical engineering from the 110 AIChE-ABET-accredited departments that reported in 1989 decreased 19% from the total reported by 128 departments in 1988, the sixth decrease in a row. At the graduate level, the number of chemical engineering master's degrees decreased for the fourth year in a row and Ph.D. degrees decreased for the first time in 10 years. The number of master's degrees was down 15% from 1988, and the number of Ph.D.s was down 8.3%.

The chemistry programs at ACS-approved schools normally are reevaluated at five-year intervals. There were 593 colleges and universities on the approved list at the end of 1989. During the year the committee studied the chemistry programs of 223 of the approved schools and of 11 schools applying for ACS approval. Each evaluation

## Summary of data from departments offering an ACS-approved program, 1985–89

| | Bachelors | | | | Masters | | Doctorates | |
|---|---|---|---|---|---|---|---|---|
| | Number of schools | Graduates (totals) | Certified graduates[a] | Noncertified graduates | Number of schools | Graduates | Number of schools | Graduates |
| **CHEMISTRY** | | | | | | | | |
| **1985** | 579 | 9679 | 4021 | 5658 | 316 | 1621 | 186 | 1806 |
| **1986** | 580 | 9295 | 3892 | 5403 | 315 | 1620 | 187 | 1885 |
| **1987** | 582 | 8848 | 3663 | 5185 | 316 | 1636 | 188 | 1936 |
| **1988** | 584 | 8372 | 3453 | 4919 | 319 | 1584 | 192 | 1955 |
| **1989** | 593 | 8122 | 3382 | 4740 | 318 | 1703 | 189 | 1967 |
| **CHEMICAL ENGINEERING[b]** | | | | | | | | |
| **1985** | 123 | 6442 | 6442 | — | 118 | 1489 | 104 | 418 |
| **1986** | 118 | 5229 | 5229 | — | 116 | 1244 | 103 | 460 |
| **1987** | 107 | 4435 | 4435 | — | 103 | 1078 | 90 | 533 |
| **1988** | 128 | 3524 | 3524 | — | 124 | 1036 | 106 | 603 |
| **1989** | 110 | 2821 | 2821 | — | 108 | 876 | 90 | 553 |

a Includes graduates certified in approved options. b Chemical engineering departments are not required to report their data to CPT, so the number of departments included in this category varies from year to year.

## Summary of totals from 1989 reports from departments offering an ACS-approved program

| | Schools reporting | Men | Women | Total |
|---|---|---|---|---|
| **CHEMISTRY** | | | | |
| **Bachelors,** Total | 593 | 5025 | 3097 | 8122 |
| Certified | | 2120 | 1262 | 3382 |
| Noncertified | | 2905 | 1835 | 4740 |
| **Masters** | 318 | 1076 | 627 | 1703 |
| **Doctorates** | 189 | 1458 | 509 | 1967 |
| **CHEMICAL ENGINEERING** | | | | |
| **Bachelors,** | | | | |
| Certified | 110 | 1977 | 844 | 2821 |
| **Masters** | 108 | 709 | 167 | 876 |
| **Doctorates** | 90 | 481 | 72 | 553 |

involved a review of extensive documentary materials submitted by the department chairman describing the current status of the program.

Three schools were added to the ACS-approved list by the committee in 1989; two were put on probation; three were removed from probation; two continued on probation; and none was removed from the list.

Last year CPT extended the 1983 guidelines for approved schools to include certified degrees in chemistry with options in biochemistry, polymer chemistry, and chemistry education. At a Division of Chemical Education symposium at the ACS national meeting in Dallas members of CPT reviewed the extension of the guidelines and pointed out that more latitude was being given to chemistry departments to develop programs that better meet the needs of the expanding discipline of chemistry. During 1989 the committee approved six programs with an option in biochemistry (1989 total is eight) and two programs in polymer chemistry. The committee is considering other options including materials chemistry and chemical physics.

CPT, in conjunction with the ACS Society Committee on Education and the ACS Committee on Science, is participating in a study by a joint Task Force on Research & Teaching. Within the context of balance between teaching and research, the task force is to identify problems in chemistry education, propose possible solutions, and recommend methods of implementation. A final report is expected to be presented at the ACS national meeting in Boston in April 1990.

In its ongoing effort to serve undergraduate students, and their faculty advisers, in choosing graduate schools appropriate to their particular interests and talents, CPT published the 1989 ACS Directory of Graduate Research. The committee is also developing a concordance of research interests for the directory. In addition, it initiated a revision of the Planning for Graduate Work in Chemistry brochure. This publication offers suggestions for students on how to prepare for graduate study, select a graduate school, apply for admission, and find financial support.

Other CPT activities in 1989 included publication of the papers presented at the symposium celebrating the 50th anniversary of CPT, review of the report of the conference on ACS Policies and Professionalism, publication of an extension of the guidelines, participation in the Committee on Professional Relations Task Force on Academic Guidelines, initiation of a study of the introductory component of the chemistry curriculum, consideration of a study of the content and organization of undergraduate laboratories, participation in the development of the ACS Education Policies for National Survival, and providing input to the ACS Publications Division and the Society Committee on Publications on a proposal for a publication on graduate programs in chemistry.

The committee would like to acknowledge and thank the following visiting associates of the committee who conducted on-site visits to schools on the approved list or applying for ACS approval during 1989: Ivan Bernal, University of Houston; John P. Chesick, Haverford College; Donald J. Darensbourg, Texas A&M University; Luther Erickson, Grinnell College; John P. Idoux, Lamar University; Paul J. Kropp, University of North Carolina, Chapel Hill; Martin J. O'Donnell, Indiana University-Purdue University; Riley O. Schaeffer, University of New Mexico; Barbara R. Shaw, Duke University. □

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American Chemical Society

## Graduate student enrollments in departments whose undergraduate chemistry programs are ACS approved

| | Number of departments | First-year graduate students | | All graduate students | |
|---|---|---|---|---|---|
| | | Full-time | Part-time | Full-time | Part-time |
| **M.S. DEPARTMENTS**[a] | | | | | |
| Fall 1984 | 131 | 468 | 270 | 1099 | 990 |
| Fall 1985 | 129 | 417 | 292 | 1106 | 962 |
| Fall 1986 | 128 | 474 | 264 | 1190 | 1051 |
| Fall 1987 | 127 | 406 | 315 | 1136 | 993 |
| Fall 1988 | 127 | 420 | 218 | 998 | 835 |
| **Ph.D. DEPARTMENTS** | | | | | |
| Fall 1984 | 186 | 3404 | 227 | 14,194 | 1314 |
| Fall 1985 | 187 | 3455 | 208 | 14,379 | 1372 |
| Fall 1986 | 187 | 3475 | 235 | 14,438 | 1355 |
| Fall 1987 | 192 | 3441 | 201 | 15,212 | 1231 |
| Fall 1988 | 189 | 3345 | 171 | 15,255 | 1111 |

a Departments whose highest offering is the master's degree in chemistry.

# Chemistry and chemical engineering degrees awarded by schools offering an ACS-approved program, 1988–89

| | CHEMISTRY | | | | CHEMICAL ENGINEERING | | |
|---|---|---|---|---|---|---|---|
| | Bachelors certified | | | | | | |
| | Yes | No | M.S. | Ph.D. | B.S. | M.S. | Ph.D. |
| **Abilene Christian U** | 4 | 1 | 3 | — | | | |
| **Adelphi U** | 0 | 3 | 2 | — | | | |
| **Agnes Scott C** | 3 | 0 | — | — | | | |
| **Akron, U of** | 27 | 2 | 1 | 12 | a | | |
| **Alabama, U of** | | | | | | | |
| Birmingham | 1 | 3 | 4 | 4 | | | |
| Huntsville | 2 | 4 | 2 | — | a | | |
| Tuscaloosa | 3 | 2 | 2 | 9 | 20 | 3 | 1 |
| **Alaska, U of** | 4 | 4 | 1 | — | | | |
| **Albion C** | 4 | 7 | — | — | | | |
| **Albright C** | 5 | 13 | — | — | | | |
| **Alfred U** | 1 | 0 | — | — | | | |
| **Allegheny C** | 0 | 19 | — | — | | | |
| **Alma C** | 1 | 4 | — | — | | | |
| **American U** | 3 | 0 | 8 | 4 | | | |
| **Amherst C** | 2 | 9 | — | — | | | |
| **Andrews U** | 9 | 2 | — | — | | | |
| **Appalachian State U** | 3 | 3 | 2 | — | | | |
| **Arizona State U** | 15 | 11 | 3 | 13 | a | | |
| **Arizona, U of** | 7 | 5 | 6 | 26 | a | | |
| **Arkansas State U** | 0 | 13 | 2 | — | | | |
| **Arkansas, U of** | | | | | | | |
| Fayetteville | 2 | 3 | 2 | 4 | | | |
| Little Rock | 5 | 6 | 1 | — | 25 | 10 | 2 |
| **Ashland U** | 0 | 4 | — | — | | | |
| **Auburn U** | 3 | 16 | 8 | 6 | 24 | 8 | 5 |
| **Augsburg C** | 3 | 5 | — | — | | | |
| **Augustana C** | | | | | | | |
| Illinois | 2 | 4 | — | — | | | |
| South Dakota | 1 | 4 | — | — | | | |
| **Austin C** | 0 | 5 | — | — | | | |
| **Baldwin-Wallace C** | 1 | 9 | — | — | | | |
| **Ball State U** | 8 | 6 | 5 | — | | | |
| **Barnard C** | 2 | 6 | — | — | | | |
| **Bates C** | 1 | 10 | — | — | | | |
| **Baylor U** | 1 | 10 | 0 | 4 | | | |
| **Beloit C** | 2 | 16 | — | — | | | |
| **Bemidji State U** | 5 | 9 | — | — | | | |
| **Birmingham-Southern C** | 3 | 7 | — | — | | | |
| **Bloomsburg U** | 1 | 4 | — | — | | | |
| **Boston C** | 13 | 0 | 1 | 3 | | | |
| **Boston U** | 6 | 10 | 3 | 7 | | | |
| **Bowdoin C** | 1 | 32 | — | — | | | |
| **Bowling Green State U** | 6 | 20 | 13 | 0 | | | |
| **Bradley U** | 1 | 9 | 0 | — | | | |
| **Brandeis U** | 0 | 7 | 5 | 5 | | | |
| **Bridgeport, U of** | 3 | 1 | 4 | — | | | |
| **Bridgewater State C** | 0 | 8 | 2 | — | | | |
| **Brigham Young U** | 22 | 15 | 2 | 5 | 17 | 9 | 7 |
| **Brown U** | 0 | 21 | 2 | 17 | a | | |
| **Bryn Mawr C** | 13 | 0 | 0 | 1 | | | |
| **Bucknell U** | 9 | 14 | 6 | — | 17 | 3 | — |
| **Butler U** | 2 | 5 | 4 | — | | | |
| **California Institute of Tech** | 13 | 0 | 9 | 34 | 6 | 4 | 11 |
| **California Polytechnic State U** | 4 | 16 | 2 | — | | | |
| **California State Poly U** | 11 | 8 | 4 | — | a | | |
| **California State U** | | | | | | | |
| Bakersfield | 6 | 7 | — | — | | | |
| Chico | 0 | 17 | — | — | | | |
| Dominguez Hills | 2 | 3 | — | — | | | |
| Fresno | 5 | 4 | 5 | — | | | |
| Fullerton | 0 | 15 | 7 | — | | | |
| Hayward | 8 | 14 | 3 | — | | | |
| Long Beach | 14 | 26 | 8 | — | a | | |
| Los Angeles | 6 | 16 | 4 | — | | | |
| Northridge | 13 | 11 | 3 | — | | | |
| Sacramento | 12 | 6 | 4 | — | | | |
| San Bernardino | 4 | 2 | — | — | | | |
| Stanislaus | 1 | 0 | — | — | | | |
| **California, U of** | | | | | | | |
| Berkeley | 20 | 45 | 13 | 65 | 54 | 12 | 21 |
| Davis | 39 | 10 | 2 | 24 | 27 | 5 | 5 |
| Irvine | 14 | 34 | 6 | 19 | | | |
| Los Angeles | 9 | 73 | 11 | 37 | a | | |
| Riverside | 12 | 1 | 10 | 7 | | | |
| San Diego | 55 | 0 | 27 | 19 | a | | |
| Santa Barbara | 23 | 0 | 11 | 9 | 18 | 6 | 2 |
| Santa Cruz | 20 | 0 | 1 | 1 | | | |
| **Calvin C** | 2 | 16 | — | — | | | |
| **Canisius C** | 7 | 8 | — | — | | | |
| **Capital U** | 0 | 4 | — | — | | | |
| **Carleton C** | 3 | 14 | — | — | | | |
| **Carnegie Mellon U** | 16 | 0 | 5 | 8 | 40 | 11 | 16 |
| **Carroll C** | 0 | 8 | — | — | | | |
| **Carthage C** | 3 | 0 | — | — | | | |
| **Case Western Reserve U** | 4 | 33 | 7 | 14 | 24 | 9 | 10 |
| **Catholic U of America** | 0 | 0 | 3 | 1 | | | |
| **Centenary C of Louisiana** | 0 | 2 | — | — | | | |
| **Central C** | 0 | 5 | — | — | | | |
| **Central Connecticut State U** | 5 | 1 | 1 | | | | |
| **Central Florida, U of** | 13 | 0 | 5 | — | | | |
| **Central Michigan U** | 5 | 13 | 4 | — | | | |
| **Central State U** | | | | | | | |
| Ohio | 0 | 1 | — | — | | | |
| Oklahoma | 3 | 6 | — | — | | | |
| **Centre C** | 0 | 5 | — | — | | | |
| **Charleston, C of** | 6 | 7 | — | — | | | |
| **Chatham C** | 3 | 1 | — | — | | | |
| **Chestnut Hill C** | 6 | 0 | — | — | | | |
| **Christian Brothers C**[b] | | | | | a | | |
| **Chicago, U of** | 13 | 21 | 15 | 21 | | | |
| **Cincinnati, U of** | 23 | 0 | 18 | 24 | 45 | 4 | 3 |
| **Citadel, The** | 5 | 2 | — | — | | | |
| **City U of New York** | | | | | | | |
| Graduate Center | — | — | 0 | 13 | | | |
| Brooklyn C | 2 | 15 | 2 | — | | | |
| City C | 2 | 6 | 6 | — | a | | |
| Herbert H. Lehman C | 3 | 3 | — | — | | | |
| Hunter C | 3 | 10 | — | — | | | |
| Queens C | 1 | 8 | 3 | — | | | |
| **Clarion U** | 3 | 0 | — | — | | | |
| **Clark U** | 6 | 9 | 2 | 1 | | | |
| **Clarkson U** | 6 | 5 | 6 | 3 | 66 | 11 | 5 |
| **Clemson U** | 5 | 2 | — | — | 18 | 8 | 1 |
| **Cleveland State U** | 9 | 4 | 2 | 1 | 11 | 4 | 2 |
| **Coe C** | 1 | 3 | — | — | | | |
| **Colby C** | 2 | 7 | — | — | | | |
| **Colgate U** | 11 | 2 | — | — | | | |
| **Colorado C** | 5 | 2 | — | — | | | |
| **Colorado School of Mines** | 7 | 0 | 6 | 1 | 56 | 13 | 3 |
| **Colorado State U** | 12 | 17 | 4 | 10 | a | | |
| **Colorado, U of** | | | | | | | |
| Boulder | 1 | 33 | 4 | 22 | 26 | 8 | 7 |
| Colorado Springs | 8 | 3 | — | — | | | |
| Denver | 6 | 5 | 4 | — | | | |
| **Columbia U** | 11 | 5 | 27 | 25 | 27 | 20 | 6 |
| **Concordia C** | 2 | 7 | — | — | | | |
| **Connecticut C** | 3 | 3 | — | — | | | |
| **Connecticut, U of** | 8 | 13 | 10 | 10 | 14 | 8 | 2 |
| **Cooper Union**[b] | | | | | a | | |
| **Cornell C** | 0 | 6 | — | — | | | |
| **Cornell U** | 22 | 18 | 32 | 37 | 26 | 2 | 10 |
| **Creighton U** | 7 | 16 | 0 | — | | | |
| **Dartmouth C** | 0 | 11 | 1 | 2 | | | |
| **David Lipscomb U** | 2 | 9 | — | — | | | |
| **Davidson C** | 5 | 8 | — | — | | | |
| **Dayton, U of** | 13 | 7 | — | — | 16 | 9 | — |
| **De Paul U** | 0 | 2 | 13 | — | | | |
| **DePauw U** | 1 | 14 | — | — | | | |
| **Delaware State C** | 3 | 0 | 1 | — | | | |
| **Delaware Valley C of Science & Agriculture** | 5 | 0 | — | — | | | |
| **Delaware, U of** | 29 | 11 | 7 | 18 | 38 | 1 | 16 |
| **Delta State U** | 1 | 8 | — | — | | | |
| **Denison U** | 0 | 6 | — | — | | | |
| **Denver, U of** | 2 | 2 | 5 | 3 | | | |
| **Detroit, U of** | 3 | 2 | 6 | 2 | a | | |
| **Dickinson C** | 1 | 11 | — | — | | | |
| **Drake U** | 4 | 0 | — | — | | | |
| **Drew U** | 4 | 6 | — | — | | | |
| **Drexel U** | 5 | 0 | 10 | 3 | 50 | 6 | 2 |
| **Duke U** | 20 | 27 | 7 | 10 | | | |
| **Duquesne U** | 4 | 6 | 8 | 2 | | | |
| **Earlham C** | 0 | 8 | — | — | | | |
| **East Carolina U** | 6 | 2 | 4 | — | | | |
| **East Stroudsburg U** | 1 | 6 | 0 | — | | | |

| | CHEMISTRY | | | | CHEMICAL ENGINEERING | | |
|---|---|---|---|---|---|---|---|
| | Bachelors certified | | | | | | |
| | Yes | No | M.S. | Ph.D. | B.S. | M.S. | Ph.D. |
| East Tennessee State U | 6 | 4 | 4 | — | | | |
| East Texas State U | 1 | 7 | 1 | — | | | |
| Eastern Illinois U | 7 | 2 | 0 | — | | | |
| Eastern Kentucky U | 1 | 14 | 1 | — | | | |
| Eastern Michigan U | 5 | 38 | 6 | — | | | |
| Eastern New Mexico U | 2 | 2 | 0 | — | | | |
| Eckerd C | 2 | 2 | — | — | | | |
| Elizabethtown C | 3 | 8 | — | — | | | |
| Elmhurst C | 0 | 15 | — | — | | | |
| Emory U | 1 | 26 | 4 | 16 | | | |
| Emporia State U | 1 | 3 | 2 | — | | | |
| Evansville, U of | 0 | 3 | — | — | | | |
| Fairfield U | 7 | 0 | — | — | | | |
| Fairleigh Dickinson U | | | | | | | |
| Madison | 6 | 0 | 5 | — | | | |
| Teaneck | 4 | 2 | 4 | — | | | |
| Fisk U | 6 | 0 | 1 | — | | | |
| Florida A&M U | 0 | 3 | — | — | | | |
| Florida Atlantic U | 3 | 13 | 1 | — | | | |
| Florida Institute of Tech | 2 | 3 | 3 | — | 7 | 2 | — |
| Florida International U | 7 | 7 | 0 | — | | | |
| Florida State U | 2 | 28 | 4 | 9 | | | |
| Florida, U of | 6 | 48 | 7 | 31 | 31 | 6 | 6 |
| Fordham U | 0 | 11 | 3 | — | | | |
| Fort Lewis C | 2 | 7 | — | — | | | |
| Framingham State C | 1 | 0 | — | — | | | |
| Franklin & Marshall C | 10 | 1 | — | — | | | |
| Furman U | 10 | 5 | 8 | — | | | |
| Geneva C | 2 | 5 | — | — | | | |
| George Mason U | 7 | 0 | 0 | — | | | |
| George Washington U | 1 | 7 | 0 | 1 | | | |
| Georgetown U | 14 | 0 | 4 | 7 | | | |
| Georgia Institute of Tech | 20 | 0 | 10 | 13 | 65 | 18 | 10 |
| Georgia State U | 6 | 5 | 5 | — | | | |
| Georgia, U of | 2 | 10 | 8 | 7 | | | |
| Gettysburg C | 5 | 1 | — | — | | | |
| Glassboro State C | 10 | 4 | — | — | | | |
| Gonzaga U | 1 | 3 | — | — | | | |
| Goucher C | 0 | 5 | — | — | | | |
| Grand Valley State U | 0 | 10 | — | — | | | |
| Grinnell C | 10 | 7 | — | — | | | |
| Gustavus Adolphus C | 6 | 7 | — | — | | | |
| Hamilton C | 0 | 1 | — | — | | | |
| Hamline U | 4 | 3 | — | — | | | |
| Hampden-Sydney C | 4 | 2 | — | — | | | |
| Hampton U | 6 | 1 | 3 | — | | | |
| Hartford, U of | 2 | 2 | 0 | — | | | |
| Hartwick C | 4 | 5 | — | — | | | |
| Harvard U | 26 | 0 | 30 | 19 | | | |
| Harvey Mudd C | 14 | 0 | — | — | | | |
| Haverford C | 8 | 0 | — | — | | | |
| Hawaii, U of | 8 | 3 | 5 | 10 | | | |
| Hendrix C | 2 | 8 | — | — | | | |
| Hiram C | 3 | 5 | — | — | | | |
| Hobart & William Smith C | 0 | 9 | — | — | | | |
| Hofstra U | 1 | 6 | — | — | | | |
| Hollins C | 0 | 1 | — | — | | | |
| Holy Cross, C of the | 15 | 8 | — | — | | | |
| Hope C | 13 | 8 | — | — | | | |
| Houston, U | 10 | 0 | 7 | 10 | a | | |
| Howard U | 0 | 20 | 5 | 5 | 11 | 4 | — |
| Humboldt State U | 0 | 5 | — | — | | | |
| Idaho State U | 2 | 4 | 1 | — | | | |
| Idaho, U of | 3 | 8 | 5 | 3 | 11 | 11 | 3 |
| Illinois Benedictine C | 16 | 0 | — | — | | | |
| Illinois Institute of Tech | 6 | 0 | 3 | 2 | 28 | 12 | 3 |
| Illinois State U | 29 | 2 | 7 | — | | | |
| Illinois Wesleyan U | 2 | 0 | — | — | | | |
| Illinois, U of | | | | | | | |
| Chicago | 15 | 24 | 10 | 12 | 14 | 4 | 4 |
| Urbana-Champaign | 52 | 61 | 17 | 33 | 70 | 15 | 13 |
| Indiana State U | 8 | 0 | 2 | — | | | |
| Indiana U | 23 | 114 | 9 | 26 | | | |
| Indiana U Northwest | 1 | 2 | — | — | | | |
| Indiana U, South Bend | 5 | 2 | — | — | | | |
| Indiana U of Pennsylvania | 13 | 7 | 3 | — | | | |
| Indiana U-Purdue U | | | | | | | |
| Fort Wayne | 2 | 1 | — | — | | | |
| Indianapolis | 0 | 20 | 8 | — | | | |
| Interamerican U of Puerto Rico | 1 | 6 | — | — | | | |
| Iowa State U | 8 | 5 | 7 | 22 | 40 | 4 | 5 |
| Iowa, U of | 19 | 2 | 12 | 12 | 22 | 2 | 4 |

| | CHEMISTRY | | | | CHEMICAL ENGINEERING | | |
|---|---|---|---|---|---|---|---|
| | Bachelors certified | | | | | | |
| | Yes | No | M.S. | Ph.D. | B.S. | M.S. | Ph.D. |
| Ithaca C | 9 | 0 | — | — | | | |
| Jackson State U | 3 | 4 | 3 | — | | | |
| James Madison U | 6 | 4 | — | — | | | |
| John Carroll C | 9 | 17 | 1 | — | | | |
| Johns Hopkins U | 9 | 5 | 10 | 10 | 12 | 4 | 5 |
| Juniata C | 6 | 8 | — | — | | | |
| Kalamazoo C | 6 | 8 | — | — | | | |
| Kansas State U | 3 | 3 | 2 | 11 | 11 | 6 | 3 |
| Kansas, U of | 9 | 29 | 5 | 3 | 17 | 4 | 2 |
| Kean C of New Jersey | 3 | 4 | — | — | | | |
| Kearney State C | 1 | 7 | — | — | | | |
| Kennesaw C | 0 | 3 | — | — | | | |
| Kent State U | 12 | 5 | 3 | 1 | | | |
| Kentucky, U of | 8 | 9 | 5 | 4 | 26 | 10 | 2 |
| Kenyon C | 8 | 14 | — | — | | | |
| King's C | 8 | 2 | — | — | | | |
| Knox C | 0 | 16 | — | — | | | |
| La Salle U | 4 | 3 | — | — | | | |
| Lafayette C | 5 | 7 | — | — | 12 | — | — |
| Lake Forest C | 5 | 5 | — | — | | | |
| Lamar U | 4 | 6 | 5 | — | 22 | 4 | 1 |
| Lawrence Technological U | 9 | 0 | — | — | | | |
| Lawrence U[c] | 6 | 3 | 8 | 4 | | | |
| Le Moyne C | 3 | 0 | — | — | | | |
| Lebanon Valley C | 6 | 1 | — | — | | | |
| Lehigh U | 8 | 2 | 16 | 9 | 36 | 9 | 11 |
| Lewis & Clark C | 2 | 3 | — | — | | | |
| Lincoln U | 2 | 7 | — | — | | | |
| Long Island U | | | | | | | |
| Brooklyn Center | 1 | 0 | 7 | — | | | |
| C. W. Post C | 0 | 1 | — | — | | | |
| Loras C | 1 | 3 | — | — | | | |
| Louisiana State U | | | | | | | |
| Baton Rouge | 5 | 2 | 3 | 18 | 21 | 18 | 5 |
| Shreveport | 7 | 0 | — | — | | | |
| Louisiana Technological U | 2 | 2 | 1 | — | 14 | 1 | 1 |
| Louisville, U of | 6 | 14 | 0 | 2 | 19 | 7 | 4 |
| Lowell, U of | 3 | 0 | 5 | 14 | 10 | 5 | — |
| Loyola C in Maryland | 2 | 0 | — | — | | | |
| Loyola Marymount U | 5 | 1 | — | — | | | |
| Loyola U | | | | | | | |
| Chicago | 10 | 6 | 2 | 5 | | | |
| New Orleans | 2 | 4 | — | — | | | |
| Luther C | 0 | 4 | — | — | | | |
| Macalester C | 1 | 9 | — | — | | | |
| Maine, U of | 2 | 3 | 4 | 3 | 25 | 6 | 2 |
| Manhattan C[d] | 13 | 6 | — | — | 8 | 16 | — |
| Manhattanville C | 2 | 1 | — | — | | | |
| Mankato State U | 4 | 10 | 1 | — | | | |
| Marietta C | 2 | 2 | — | — | | | |
| Marist C | 4 | 0 | — | — | | | |
| Marquette U | 9 | 0 | 4 | 4 | | | |
| Marshall U | 2 | 22 | 1 | — | | | |
| Maryland, U of | | | | | | | |
| Baltimore County | 9 | 16 | 2 | 1 | a | | |
| College Park | 8 | 39 | 15 | 16 | a | | |
| Massachusetts Institute of Tech | 26 | 0 | 1 | 43 | 45 | 37 | 29 |
| Massachusetts, U of | 18 | 9 | 17 | 25 | 24 | 5 | 17 |
| McNeese State U | 3 | 3 | 2 | — | | | |
| Memphis State U | 1 | 3 | 3 | 2 | | | |
| Mercer U | 0 | 8 | — | — | | | |
| Merrimack C | 1 | 3 | — | — | | | |
| Metropolitan State C | 13 | 18 | — | — | | | |
| Miami U | 14 | 27 | 5 | 6 | | | |
| Miami, U of | 3 | 28 | 4 | 4 | | | |
| Michigan State U | 19 | 9 | 2 | 22 | 41 | 14 | 5 |
| Michigan Technological U | 11 | 0 | 4 | 1 | 42 | 9 | — |
| Michigan, U of | | | | | | | |
| Ann Arbor | 44 | 0 | 21 | 19 | 50 | 15 | 16 |
| Dearborn | 16 | 11 | — | — | | | |
| Flint | 4 | 3 | — | — | | | |
| Middle Tennessee State U | 0 | 18 | 4 | — | | | |
| Middlebury C | 2 | 17 | — | — | | | |
| Midwestern State U | 2 | 2 | — | — | | | |
| Millersville U | 0 | 13 | — | — | | | |
| Millsaps C | 2 | 20 | — | — | | | |
| Minnesota, U of | | | | | | | |
| Minneapolis | 32 | 0 | 10 | 29 | a | | |
| Duluth | 11 | 12 | 4 | — | | | |
| Mississippi C | 1 | 4 | — | — | | | |
| Mississippi State U | 1 | 10 | 5 | 2 | a | | |

| | CHEMISTRY | | | | CHEMICAL ENGINEERING | | |
|---|---|---|---|---|---|---|---|
| | Bachelors certified | | | | | | |
| | Yes | No | M.S. | Ph.D. | B.S. | M.S. | Ph.D. |
| Mississippi, U of | 3 | 12 | 1 | 1 | 5 | 3 | 2 |
| Missouri Western State C | 7 | 0 | — | — | | | |
| Missouri, U of | | | | | | | |
| Columbia | 14 | 7 | 11 | 3 | a | | |
| Kansas City | 3 | 11 | 0 | 2 | | | |
| Rolla | 7 | 0 | 3 | 6 | 61 | 13 | 1 |
| St. Louis | 7 | 8 | 5 | 4 | | | |
| Monmouth C | 2 | 0 | — | — | | | |
| Montana C of Mineral Science & Technology | 4 | 1 | 3 | — | | | |
| Montana State U | 8 | 6 | 0 | 7 | 22 | 8 | 1 |
| Montana, U of | 5 | 4 | 1 | 0 | | | |
| Montclair State C | 2 | 10 | 3 | — | | | |
| Moorhead State U | 3 | 0 | — | — | | | |
| Moravian C | 2 | 7 | — | — | | | |
| Morehouse C[c] | 2 | 0 | 6 | 0 | | | |
| Morgan State U | 2 | 4 | — | — | | | |
| Mount Holyoke C | 0 | 7 | 3 | 0 | | | |
| Mount Saint Vincent, C of[d] | 0 | 0 | — | — | | | |
| Muhlenberg C | 0 | 13 | — | — | | | |
| Murray State U | 5 | 8 | 6 | — | | | |
| Muskingum C | 1 | 7 | — | — | | | |
| Nebraska, U of | | | | | | | |
| Lincoln | 3 | 9 | 9 | 20 | a | | |
| Omaha | 8 | 3 | — | — | | | |
| Nebraska Wesleyan U | 1 | 4 | — | — | | | |
| Nevada, U of | | | | | | | |
| Las Vegas | 5 | 3 | 0 | — | | | |
| Reno | 0 | 5 | 3 | 2 | | | |
| New Hampshire, U of | 7 | 5 | 6 | 3 | a | | |
| New Jersey Institute of Tech[b] | | | | | a | | |
| New Mexico Highlands U | 0 | 0 | 0 | — | | | |
| New Mexico Institute of Mining & Tech | 5 | 0 | 6 | 1 | | | |
| New Mexico State U | 0 | 22 | 7 | 3 | 12 | 8 | 1 |
| New Mexico, U of | 10 | 6 | 9 | 8 | 10 | 8 | 1 |
| New Orleans, U of | 0 | 10 | 2 | 1 | | | |
| New York U | 1 | 56 | 13 | 6 | | | |
| Niagara U | 1 | 9 | — | — | | | |
| North Alabama, U of | 6 | 11 | — | — | | | |
| North Carolina A&T State U | 6 | 0 | 2 | — | | | |
| North Carolina Central U | 2 | 5 | 4 | — | | | |
| North Carolina State U | 41 | 21 | 5 | 5 | 77 | 5 | 7 |
| North Carolina, U of | | | | | | | |
| Asheville | 3 | 2 | — | — | | | |
| Chapel Hill | 26 | 51 | 8 | 17 | | | |
| Charlotte | 1 | 9 | 2 | — | | | |
| Greensboro | 9 | 7 | 8 | — | | | |
| Wilmington | 4 | 4 | — | — | | | |
| North Dakota State U | 2 | 13 | 4 | 9 | | | |
| North Dakota, U of | 6 | 6 | 2 | 4 | 15 | 1 | — |
| North Texas, U of | 3 | 3 | 9 | 7 | | | |
| Northeast Louisiana U | 2 | 1 | 3 | — | | | |
| Northeast Missouri State U | 9 | 5 | — | — | | | |
| Northeastern Illinois U | 2 | 12 | 6 | — | | | |
| Northeastern U | 0 | 9 | 5 | 12 | a | | |
| Northern Arizona U | 6 | 23 | 2 | — | | | |
| Northern Colorado, U of | 4 | 2 | 0 | 0 | | | |
| Northern Illinois U | 11 | 15 | 5 | 4 | | | |
| Northern Iowa, U of | 4 | 17 | 0 | — | | | |
| Northern Kentucky U | 1 | 2 | — | — | | | |
| Northern Michigan U | 0 | 3 | 0 | — | | | |
| Northwest Missouri State U | 1 | 6 | — | — | | | |
| Northwestern State U | 0 | 0 | — | — | | | |
| Northwestern U | 7 | 9 | 41 | 18 | 15 | 2 | 12 |
| Notre Dame, U of | 2 | 12 | 2 | 11 | 26 | 9 | 11 |
| Oakland U | 2 | 9 | 2 | — | | | |
| Oberlin C | 10 | 11 | — | — | | | |
| Occidental C | 4 | 17 | — | — | | | |
| Ohio Northern U | 1 | 0 | — | — | | | |
| Ohio State U | 34 | 0 | 24 | 28 | 39 | 16 | 14 |
| Ohio U | 10 | 9 | 1 | 3 | 12 | 7 | 2 |
| Ohio Wesleyan U | 2 | 4 | — | — | | | |
| Oklahoma State U | 4 | 1 | 3 | 4 | 23 | 14 | 8 |
| Oklahoma, U of | 10 | 16 | 9 | 11 | a | | |
| Old Dominion U | 7 | 6 | 5 | — | | | |
| Oregon State U | 10 | 0 | 4 | 6 | 29 | 16 | 4 |
| Oregon, U of | 2 | 19 | 8 | 10 | | | |
| Pace U | | | | | | | |
| New York | 2 | 2 | — | — | | | |
| Pleasantville | 3 | 3 | — | — | | | |
| Pacific Lutheran U | 3 | 9 | — | — | | | |
| Pacific, U of the | 0 | 9 | 0 | 0 | | | |
| Pennsylvania State U | 9 | 25 | 9 | 36 | 92 | 21 | 6 |
| Pennsylvania, U of | 3 | 15 | 3 | 22 | 14 | 11 | 7 |
| Philadelphia C of Pharmacy & Science | 2 | 1 | 1 | 1 | | | |
| Philadelphia C of Textiles & Science | 2 | 0 | — | — | | | |
| Pittsburgh State U | 3 | 3 | 3 | — | | | |
| Pittsburgh, U of | 13 | 65 | 6 | 22 | 44 | 11 | 8 |
| Polytechnic U | 2 | 0 | 10 | 11 | 15 | 11 | 6 |
| Pomona C | 2 | 4 | — | — | | | |
| Portland State U | 1 | 9 | 3 | 3 | | | |
| Portland, U of | 2 | 0 | — | — | | | |
| Pratt Institute[b] | | | | | a | | |
| Princeton U | 10 | 7 | 19 | 17 | 14 | 0 | 15 |
| Providence C | 2 | 3 | 0 | 0 | | | |
| Puerto Rico, U of | | | | | | | |
| Mayaguez | 2 | 7 | 6 | — | 43 | 7 | — |
| Rio Piedras | 4 | 31 | 4 | 4 | | | |
| Puget Sound, U of | 3 | 3 | — | — | | | |
| Purdue U | 19 | 23 | 13 | 49 | 92 | 14 | 14 |
| Purdue U Calumet | 1 | 0 | — | — | | | |
| Ramapo C of New Jersey | 3 | 2 | — | — | | | |
| Randolph Macon C | 1 | 2 | — | — | | | |
| Randolph-Macon Woman's C | 0 | 2 | — | — | | | |
| Redlands, U of | 0 | 3 | — | — | | | |
| Reed C | 5 | 4 | — | — | | | |
| Rensselaer Polytechnic Inst | 18 | 0 | 13 | 12 | 37 | 7 | 10 |
| Rhode Island C | 7 | 5 | — | — | | | |
| Rhode Island, U of | 2 | 1 | 6 | 2 | 14 | 3 | 3 |
| Rhodes C | 1 | 8 | — | — | | | |
| Rice U | 1 | 5 | 16 | 14 | 14 | 5 | 6 |
| Richmond, U of | 5 | 9 | — | — | | | |
| Rider C | 2 | 0 | — | — | | | |
| Ripon C | 5 | 2 | — | — | | | |
| Roanoke C | 3 | 3 | — | — | | | |
| Rochester Institute of Tech | 5 | 22 | 6 | — | | | |
| Rochester, U of | 2 | 7 | 20 | 21 | 17 | 13 | 9 |
| Rockhurst C | 2 | 3 | — | — | | | |
| Rollins C | 1 | 0 | — | — | | | |
| Roosevelt U | 5 | 1 | 4 | — | | | |
| Rose-Hulman Institute of Tech | 11 | 0 | — | — | 25 | 2 | — |
| Russell Sage C | 2 | 4 | — | — | | | |
| Rutgers U | | | | | | | |
| Camden C | 2 | 1 | — | — | | | |
| New Brunswick | 5 | 34 | 5 | 17 | 26 | 10 | 9 |
| Newark C of Arts & Sciences | 10 | 7 | 6 | 6 | | | |
| Saginaw Valley State U | 3 | 9 | — | — | | | |
| St. Anselm C | 2 | 1 | — | — | | | |
| St. Catherine, C of | 0 | 7 | — | — | | | |
| St. Cloud State U | 9 | 5 | — | — | | | |
| St. John Fisher C | 3 | 0 | — | — | | | |
| St. John's U/C of St. Benedict | 4 | 4 | — | — | | | |
| St. John's U | 4 | 0 | 2 | — | | | |
| St. Joseph C | 3 | 0 | 7 | — | | | |
| St. Joseph's U | 11 | 8 | 7 | — | | | |
| St. Lawrence U | 2 | 4 | — | — | | | |
| St. Louis U | 7 | 8 | 3 | — | | | |
| St. Mary's C | 0 | 11 | — | — | | | |
| St. Michael's C | 0 | 0 | — | — | | | |
| St. Olaf C | 1 | 47 | — | — | | | |
| St. Peter's C | 2 | 0 | — | — | | | |
| St. Thomas, C of | 1 | 10 | — | — | | | |
| Salem State C | 1 | 0 | — | — | | | |
| Sam Houston State U | 2 | 3 | 3 | — | | | |
| San Diego State U | 27 | 0 | 15 | 1 | | | |
| San Francisco State U | 5 | 23 | 5 | — | | | |
| San Francisco, U of | 2 | 2 | 0 | — | | | |
| San Jose State U | 26 | 7 | 6 | — | a | | |
| Sangamon State U | 3 | 0 | — | — | | | |
| Santa Clara U | 2 | 10 | — | — | | | |
| Scranton, U of | 5 | 15 | 11 | — | | | |
| Seattle U | 1 | 6 | — | — | | | |
| Seton Hall U | 6 | 10 | 11 | 2 | | | |
| Shippensburg U | 8 | 5 | 1 | — | | | |
| Siena C | 6 | 0 | — | — | | | |
| Simmons C | 0 | 1 | — | — | | | |
| Skidmore C | 0 | 12 | — | — | | | |
| Smith C | 2 | 3 | 0 | 0 | | | |
| Sonoma State U | 1 | 14 | — | — | | | |
| South Alabama, U of[b] | | | | | 10 | 0 | — |
| South Carolina, U of | 3 | 16 | 6 | 14 | 14 | 4 | 0 |

| | CHEMISTRY | | | | CHEMICAL ENGINEERING | | |
|---|---|---|---|---|---|---|---|
| | Bachelors certified | | | | | | |
| | Yes | No | M.S. | Ph.D. | B.S. | M.S. | Ph.D. |
| South Dakota School of Mines & Tech | 6 | 2 | 1 | — | 19 | 4 | — |
| South Dakota State U | 0 | 29 | 4 | — | | | |
| South Dakota, U of | 5 | 12 | 2 | — | | | |
| South Florida, U of | 18 | 24 | 2 | 3 | 15 | 9 | 1 |
| Southeast Missouri State U | 2 | 6 | — | — | | | |
| Southeastern Louisiana U | 0 | 0 | — | — | | | |
| Southeastern Massachusetts U | 8 | 6 | 6 | — | | | |
| Southern California, U of | 9 | 4 | 1 | 22 | 10 | 8 | 2 |
| Southern Colorado U | 1 | 9 | 0 | — | | | |
| Southern Illinois U | | | | | | | |
| Carbondale | 4 | 6 | 7 | 8 | | | |
| Edwardsville | 11 | 2 | 4 | — | | | |
| Southern Methodist U | 4 | 2 | 0 | — | | | |
| Southern Mississippi, U of | 0 | 19 | 1 | 4 | | | |
| Southern Oregon State C | 6 | 6 | — | — | | | |
| Southern U and A&M C | 3 | 6 | 2 | — | | | |
| Southwest Missouri State U | 6 | 13 | — | — | | | |
| Southwest State U | 5 | 2 | — | — | | | |
| Southwest Texas State U | 17 | 2 | 4 | — | | | |
| Southwestern Louisiana, U of | 1 | 11 | 2 | — | 15 | 4 | — |
| Southwestern Oklahoma State U | 1 | 3 | — | — | | | |
| Stanford U | 8 | 2 | 6 | 21 | 6 | 9 | 11 |
| State U of New York | | | | | | | |
| Albany | 13 | 2 | 3 | 4 | | | |
| Binghamton | 7 | 15 | 13 | 6 | | | |
| Buffalo | 14 | 10 | 8 | 15 | 46 | 9 | 12 |
| Stony Brook | 13 | 15 | 9 | 19 | | | |
| C at Brockport | 1 | 5 | — | — | | | |
| C at Buffalo | 4 | 7 | 4 | — | | | |
| C at Cortland | 1 | 4 | — | — | | | |
| C at Fredonia | 6 | 2 | 0 | — | | | |
| C at Geneseo | 3 | 2 | — | — | | | |
| C at New Paltz | 2 | 2 | 1 | — | | | |
| C at Oneonta | 0 | 17 | 0 | — | | | |
| C at Oswego | 6 | 4 | 5 | — | | | |
| C at Plattsburgh | 11 | 5 | 3 | — | | | |
| C at Potsdam | 0 | 14 | — | — | | | |
| C at Purchase | 2 | 5 | — | — | | | |
| Stephen F. Austin State U | 5 | 0 | 1 | — | | | |
| Stetson U | 2 | 4 | — | — | | | |
| Stevens Institute of Tech | 3 | 3 | 7 | 3 | 7 | 10 | 5 |
| Stockton State C | 1 | 9 | — | — | | | |
| Suffolk U | 0 | 2 | — | — | | | |
| Susquehanna U | 0 | 2 | — | — | | | |
| Swarthmore C | 4 | 4 | — | — | | | |
| Syracuse U | 7 | 8 | 2 | 11 | 12 | 9 | 7 |
| Temple U | 12 | 0 | 3 | 5 | | | |
| Tennessee Technological U | 2 | 6 | 3 | — | 18 | 1 | 1 |
| Tennessee, U of | | | | | | | |
| Chattanooga | 10 | 13 | — | — | | | |
| Knoxville | 3 | 11 | 6 | 7 | 33 | 12 | 2 |
| Martin | 0 | 9 | — | — | | | |
| Texas A&I U | 8 | 1 | 1 | — | 10 | 5 | — |
| Texas A&M U | 11 | 10 | 9 | 34 | 50 | 16 | 16 |
| Texas Christian U | 1 | 17 | 3 | 1 | | | |
| Texas Southern U | 3 | 0 | 4 | — | | | |
| Texas Tech U | 11 | 10 | 4 | 7 | a | | |
| Texas Woman's U | 2 | 1 | 3 | 0 | | | |
| Texas, U of | | | | | | | |
| Arlington | 9 | 7 | 1 | 13 | | | |
| Austin | 53 | 0 | 6 | 32 | 66 | 9 | 12 |
| Dallas | 3 | 0 | 2 | 2 | | | |
| El Paso | 3 | 0 | 9 | — | | | |
| Thiel C | 0 | 2 | — | — | | | |
| Thomas More C | 2 | 0 | — | — | | | |
| Toledo, U of | 4 | 9 | 5 | 2 | 19 | 11 | 2 |
| Towson State U | 1 | 6 | — | — | | | |
| Trenton State C | 7 | 0 | — | — | | | |
| Tri-State U[b] | | | | | a | | |
| Trinity C | 15 | 1 | 0 | — | | | |
| Trinity U | 6 | 17 | — | — | | | |
| Tufts U | 0 | 6 | 1 | 4 | 15 | 11 | — |
| Tulane U of Louisiana | 0 | 6 | 0 | 2 | 6 | 3 | 2 |
| Tulsa, U of | 4 | 0 | — | — | 17 | 5 | 1 |
| Tuskegee Institute | 0 | 1 | 1 | — | 4 | — | — |
| Union C | 2 | 14 | — | — | | | |
| U. S. Air Force Academy | 9 | 4 | — | — | | | |
| U. S. Naval Academy | 17 | 0 | — | — | | | |
| Ursinus C | 3 | 10 | — | — | | | |
| Utah State U | 11 | 0 | 5 | 3 | | | |
| Utah, U of | 4 | 19 | 6 | 10 | a | | |
| Valparaiso U | 1 | 15 | — | — | | | |
| Vanderbilt U | 1 | 9 | 6 | 5 | 18 | 3 | 2 |
| Vassar C | 2 | 3 | 3 | — | | | |
| Vermont, U of | 8 | 0 | 3 | 7 | | | |
| Villanova U | 8 | 0 | 14 | 2 | 17 | 9 | — |
| Virginia Commonwealth U | 8 | 8 | 1 | 4 | | | |
| Virginia Military Institute | 8 | 0 | — | — | | | |
| Virginia Polytechnic Institute & State U | 21 | 12 | 8 | 18 | 38 | 6 | 8 |
| Virginia, U of | 6 | 77 | 11 | 22 | 21 | 12 | 6 |
| Wabash C | 4 | 13 | — | — | | | |
| Wagner C | 4 | 4 | — | — | | | |
| Wake Forest U | 14 | 11 | 2 | 0 | | | |
| Washburn U | 3 | 3 | — | — | | | |
| Washington C | 0 | 0 | — | — | | | |
| Washington State U | 6 | 8 | 3 | 3 | 17 | 7 | 1 |
| Washington U | 5 | 4 | 15 | 9 | 21 | 6 | 6 |
| Washington, U of | 33 | 19 | 20 | 22 | a | | |
| Washington & Jefferson C | 3 | 23 | — | — | | | |
| Washington & Lee U | 0 | 11 | — | — | | | |
| Wayne State U | 15 | 35 | 10 | 22 | 41 | 13 | 3 |
| Waynesburg C | 1 | 2 | — | — | | | |
| Weber State C | 6 | 2 | — | — | | | |
| Wellesley C | 8 | 23 | — | — | | | |
| Wesleyan U | 0 | 8 | 1 | 8 | | | |
| West Chester U | 3 | 18 | 2 | — | | | |
| West Florida, U of | 2 | 2 | — | — | | | |
| West Texas State U | 1 | 7 | 0 | — | | | |
| West Virginia Institute of Tech[b] | | | | | 12 | 1 | — |
| West Virginia State C | 5 | 9 | — | — | | | |
| West Virginia U | 13 | 38 | 5 | 5 | 16 | 6 | 3 |
| Western Illinois U | 1 | 6 | 7 | — | | | |
| Western Kentucky U | 1 | 21 | 2 | — | | | |
| Western Maryland C | 0 | 2 | — | — | | | |
| Western Michigan U | 1 | 8 | 1 | 1 | | | |
| Western New England C | 0 | 0 | — | — | | | |
| Western Washington U | 13 | 15 | 1 | — | | | |
| Westminster C | 0 | 1 | — | — | | | |
| Wheaton C | | | | | | | |
| Illinois | 9 | 10 | — | — | | | |
| Massachusetts | 3 | 0 | — | — | | | |
| Wheeling Jesuit C | 0 | 2 | — | — | | | |
| Whitman C | 2 | 2 | — | — | | | |
| Whittier C | 0 | 7 | — | — | | | |
| Wichita State U | 4 | 10 | 4 | 0 | | | |
| Widener U | 2 | 1 | — | — | 5 | 0 | — |
| Wilkes C | 3 | 0 | — | — | | | |
| Willamette U | 2 | 7 | — | — | | | |
| William Paterson C of N.J. | 0 | 6 | — | — | | | |
| William and Mary, C of | 13 | 8 | 7 | — | | | |
| Williams C | 3 | 20 | — | — | | | |
| Winona State U | 5 | 1 | — | — | | | |
| Wisconsin, U of | | | | | | | |
| Eau Claire | 5 | 8 | — | — | | | |
| Green Bay | 1 | 11 | — | — | | | |
| LaCrosse | 3 | 19 | — | — | | | |
| Madison | 42 | 3 | 12 | 38 | 24 | 15 | 2 |
| Milwaukee | 2 | 13 | 4 | 6 | | | |
| Oshkosh | 4 | 4 | — | — | | | |
| Parkside | 4 | 9 | — | — | | | |
| Platteville | 0 | 2 | — | — | | | |
| River Falls | 8 | 4 | — | — | | | |
| Stevens Point | 12 | 8 | — | — | | | |
| Superior | 3 | 2 | — | — | | | |
| Wittenberg U | 2 | 7 | — | — | | | |
| Wooster, C of | 10 | 14 | — | — | | | |
| Worcester Polytechnic Institute | 3 | 8 | 0 | 1 | a | | |
| Wright State U | 14 | 10 | 10 | — | | | |
| Wyoming, U of | 6 | 0 | 1 | 4 | 6 | 4 | 0 |
| Xavier U | 2 | 5 | — | — | | | |
| Xavier U of Louisiana | 1 | 30 | — | — | | | |
| Yale U | 0 | 15 | 32 | 20 | 1 | 8 | 3 |
| Youngstown State U | 8 | 54 | 5 | — | a | | |
| TOTALS | 3382 | 4740 | 1703 | 1967 | 2821 | 876 | 553 |

Note: For brevity, "B.S." and "M.S." are used to denote all bachelor's and master's degrees, respectively, in each column. a Data not submitted. b Listed on basis of accreditation by AICHE-ABET. c Master's and Ph.D. degrees given by the Institute of Paper Chemistry. d The chemistry programs at Mount Saint Vincent and Manhattan College are integrated into a combined department with all instruction in chemistry located at Manhattan College e Master's and Ph.D. degrees given by Clark Atlanta University.

# Berkeley, Indiana top producers of chemists

For the fifth year in a row the University of California, Berkeley, has graduated more Ph.D. chemists, 65, than any other school in the country and Indiana University has produced the most bachelor's degree chemists, 137.

These are two of the highlights contained in the data in the latest annual report of ACS's Committee on Professional Training (see page 29). As usual, the report, which covers the 1988-89 academic year, tabulates the number of doctoral, master's, and bachelor's degree graduates for all departments with a bachelor's degree program approved by the committee.

Berkeley has topped the list of Ph.D. producers for eight of the past 16 years. For the other eight years the honor went to the University of Illinois, Urbana-Champaign. For 1988-89 Illinois slipped from second place the previous year to ninth with 33 doctoral graduates while Purdue moved up from eighth to second with 49. Massachusetts Institute of Technology took the third spot with 43, moving up from fifth the previous year.

Illinois held on to second place in the ranking of new bachelor's degree chemists with 113. The University of Virginia moved up from sixth to take third place with 83.

The biggest changes came in the rankings for bachelor's degrees certified by ACS. Such graduates are immediately eligible for membership of ACS. Berkeley fell from the top of the list for 1987-88 with 67 graduates to 25th with 20. University of California, San Diego, moved up from 11th to first with 55 such graduates.

Northwestern University moved up from fourth to top the list of master's degrees with 41. Cornell moved up from third to second with 32.

Illinois, the University of Washington, and UC Berkeley were the only three schools to rank in the first 25 for all categories—bachelor's graduates, ACS-certified bachelor's graduates, master graduates, and Ph.D.s.

*Michael Heylin*

## These schools had the most chemistry graduates, 1988–89

**Total bachelor graduates**

| | | |
|---|---|---|
| 1. | Indiana U | 137 |
| 2. | U of Illinois, Urbana-Champaign | 113 |
| 3. | U of Virginia | 83 |
| 4. | U of California, Los Angeles | 82 |
| 5. | U of Pittsburgh | 78 |
| 6. | U of North Carolina, Chapel Hill | 77 |
| 7. | U of California, Berkeley | 65 |
| 8. | Youngstown State U | 63 |
| 9 | North Carolina State U | 62 |
| 10. | New York U | 57 |
| 11. | U of California, San Diego | 55 |
| 12. | U of Florida | 54 |
| 13. | of Texas, Austin | 53 |
| 14. | U of Washington | 52 |
| 15. | West Virginia U | 51 |
| 16. | Wayne State U | 50 |
| 17. | U of California, Davis | 49 |
| 18. | U of California, Irvine | 48 |
| 18. | St. Olaf C | 48 |
| 20. | Duke U | 47 |
| 20. | U of Maryland, College Park | 47 |
| 22. | U of Wisconsin, Madison | 45 |
| 23. | U of Michigan, Ann Arbor | 44 |
| 24. | Eastern Michigan U | 43 |
| 25. | Purdue U | 42 |
| 25. | U of South Florida | 42 |

**Certified bachelor graduates**

| | | |
|---|---|---|
| 1. | U of California, San Diego | 55 |
| 2. | U of Texas, Austin | 53 |
| 3. | U of Illinois, Urbana-Champaign | 52 |
| 4. | U of Michigan, Ann Arbor | 44 |
| 5. | U of Wisconsin, Madison | 42 |
| 6. | North Carolina State U | 41 |
| 7. | U of California, Davis | 39 |
| 8. | Ohio State U | 34 |
| 9. | U of Washington | 33 |
| 10. | U of Minnesota, Minneapolis | 32 |
| 11. | U of Delaware | 29 |
| 11. | Illinois State U | 29 |
| 13. | U of Akron | 27 |
| 13. | San Diego State U | 27 |
| 15. | Harvard U | 26 |
| 15. | Massachusetts Inst of Tech | 26 |
| 15. | U of North Carolina, Chapel Hill | 26 |
| 15. | San Jose State U | 26 |
| 19. | U of California, Santa Barbara | 23 |
| 19. | U of Cincinnati | 23 |
| 19. | Indiana U | 23 |
| 22. | Brigham Young U | 22 |
| 22. | Cornell U | 22 |
| 24. | Virginia Polytech Inst & State U | 21 |
| 25. | U of California, Berkeley | 20 |
| 25. | U of California, Santa Cruz | 20 |
| 25. | Duke U | 20 |
| 25. | Georgia Institute of Tech | 20 |

**Master graduates**

| | | |
|---|---|---|
| 1. | Northwestern U | 41 |
| 2. | Cornell U | 32 |
| 2. | Yale U | 32 |
| 4. | Harvard U | 30 |
| 5. | U of California, San Diego | 27 |
| 5. | Columbia U | 27 |
| 7. | Ohio State U | 24 |
| 8. | U of Michigan, Ann Arbor | 21 |
| 9. | U of Rochester | 20 |
| 9. | U of Washington | 20 |
| 11. | Princeton U | 19 |
| 12. | U of Cincinnati | 18 |
| 13. | U of Illinois, Urbana-Champaign | 17 |
| 13. | U of Massachusetts | 17 |
| 15. | Lehigh U | 16 |
| 15. | Rice U | 16 |
| 17. | U of Chicago | 15 |
| 17. | U of Maryland, College Park | 15 |
| 17. | San Diego State U | 15 |
| 17. | Washington U | 15 |
| 21. | Villanova U | 14 |
| 22. | Bowling Green State U | 13 |
| 22. | U of California, Berkeley | 13 |
| 22. | De Paul U | 13 |
| 22. | New York U | 13 |
| 22. | Purdue U | 13 |
| 22. | Rensselaer Polytech Inst | 13 |
| 22. | State U of New York, Binghamton | 13 |

**Doctoral graduates**

| | | |
|---|---|---|
| 1. | U of California, Berkeley | 65 |
| 2. | Purdue U | 49 |
| 3. | Massachusetts Inst of Tech | 43 |
| 4. | U of Wisconsin, Madison | 38 |
| 5. | U of California, Los Angeles | 37 |
| 5. | Cornell U | 37 |
| 7. | Pennsylvania State U | 36 |
| 8. | Texas A&M U | 34 |
| 9. | U of Illinois, Urbana-Champaign | 33 |
| 10. | U of Texas, Austin | 32 |
| 11. | U of Florida | 31 |
| 12. | U of Minnesota, Minneapolis | 29 |
| 13. | Ohio State U | 28 |
| 14. | U of Arizona | 26 |
| 14. | Indiana U | 26 |
| 16. | Columbia U | 25 |
| 16. | U of Massachusetts | 25 |
| 18. | U of California, Davis | 24 |
| 18. | U of Cincinnati | 24 |
| 20. | U of Colorado, Boulder | 22 |
| 20. | Iowa State U | 22 |
| 20. | Michigan State U | 22 |
| 20. | U of Pennsylvania | 22 |
| 20. | U of Pittsburgh | 22 |
| 20. | U of Southern California | 22 |
| 20. | U of Virginia | 22 |
| 20. | U of Washington | 22 |
| 20. | Wayne State U | 22 |